Solar Energy and Wind Energy Integrated Power System Design and Scheme to Discussin in Dongying Area

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Abstract

We designed solar energy integrated power system in Dongying area, did accounting from the total generating capacity, and profit and loss quantity and system cost on various power generation scheme. Through the accounting, we find in dongying area using solar wind integrated power generation scheme ratio is the highest, the wind power generation for optimal scheme is given priority to.

Key words

Solar Energy; Wind Energy; Integrated Power System; Discuss

Introduction

According to the climate characteristics in Dongying area, we researched the feasibility of comprehensive generate electricity using solar and wind energy in Dongying area. According to the research conclusion, we designed comprehensive generate electricity system with solar and photovoltaics in Dongying area, discussed power generation scheme, and did generating cost accounting.

Solar Wind Integrated Power System Design

Solar power generation system is composed of solar battery, solar controller, storage battery composition, Such as the output power of ac 220 v or 110 v, also need to be configured inverter and other equipment(http://bbs.hcbbs.com/thread-609096-1-1.html) the principle of wind power is the use of pneumatic drive windmill blade rotation, again through the growth machine will rotate speed ascend, to promote the generator power generation(Wang *et al* 2011, 14(3)). At present in our country, 3 m/s breeze, windmill can power generation. Based on the above principle, the paper presents the design of solar wind integrated power system scheme, its principle as shown in figure 1 shows. When the pv panel and wind power generation unit normal work, the control system from the electrical transport to load, the remaining to battery charging system. Scenery comprehensive power system working principle see(Yang *et al* 2007, 12 and Shu *et al* 2010, 24(4)).

Solar Wind Integrated Power Solutions to Explore

Using SSR type blower, Q = 1 m3 / min, N = 0.75 kW; Plus auxiliary equipment, the total power 0.85 kW. Run time: equipment running every day 6 h; Battery is full of electricity that can be run after the day of overcast and rainy for 2 d; System dc working voltage is 24 v; On an average day for power consumption is

$$Q_L = 0.85 \times 6 = 5.1KWh \quad (1)$$

Therefore, load produced power consumption as is shown in table 1.

TABLE 1 LOAD PRODUCED ELECTRIC POWER CONSUMPTION

month	Power consumption /kWh	month	Power consumption /kWh
1	158.1	7	158.1
2	142.8	8	158.1
3	158.1	9	153.0
4	153.0	10	158.1
5	158.1	11	153.0
6	153.0	12	158.1

We could get the wind condition in Dongying area, according to the wind speed measured data provided by weather station. In the design, select start wind speed for 3 m/s wind generators, rated wind speed is 8 m/s, which can calculate the Dongying area 1 kw wind generator capacity produced, such as shown in table 2.

TABLE 2 DONGYING AREA 1 KW WIND GENERATOR CAPACITY WAS PRODUCED

month	Power generation /kWh	month	Power generation /kWh
1	62.77	7	15.74
2	89.12	8	15.74
3	106.01	9	13.99
4	97.36	10	12.81
5	50.80	11	29.04
6	21.64	12	25.16

Through Table 2, it is known that the October wind power generation is minimum, only 12.81 kWh; According to the requirement of design, and the battery maintenance days is 2d, and the capacity of the battery has reserved is

$$Q_b = N \cdot Q_L = 2 \times 5.1 = 10.2KWh \quad (2)$$

All in Wind Power Generation

Through Table 2, it is known that the Dongying area capacity in October at least. So in October, equipped with the size of the wind generator should also can meet the requirements of the load power consumption, and at the same time, considering the battery can maintain 2 d, so the wind generator power is

$$P_f = \frac{Q_{c10} - Q_b}{E_{f10}} = \frac{158.1 - 10.2}{12.81} = 11.55KW \quad (3)$$

All wind power generation and power consumption was produced in table 3. According to the wind generator specification, the actual usable 12 kw wind generator.

TABLE 3 FULL WIND POWER GENERATION AND POWER CONSUMPTION WAS PRODUCED

month	Power generation /kWh	Power consumption /kWh	Amount of profit and loss/kWh
1	724.99	158.10	566.89
2	1029.34	142.80	886.54
3	1224.42	158.10	1066.32
4	1124.51	153.00	971.51
5	586.74	158.10	428.64
6	249.94	153.00	96.94
7	181.80	158.10	23.70
8	181.80	158.10	23.70
9	161.58	153.00	8.58
10	147.96	158.10	-10.14
11	335.41	153.00	182.41
12	290.60	158.10	132.50

All Use Solar Photovoltaic Power Generation

According to the literature(Tan and Wei, 2009, 25(3)) discusses pv optimization design principle, according to Dongying area each month and year the average solar total radiation quantity and direct exposure. According to the literature(Chow and Fong, 1996, 93(2)), it is concluded that 14 ° for solar cell phalanx best Angle, the capacity of the minimum in October. Among them, the system power needs to meet type (4-4)

$$Q_c = n_2 Q_v + Q_b \quad (4)$$

At the same time meet the minimum investment, it is concluded that produced generating capacity and profit and loss quantity such as shown in table 4. Solar cell power for; Consider solar panel specifications, the actual usable 1.7 kW of photovoltaic phalanx.

TABLE 4 THE WHOLE PHOTOVOLTAIC POWER GENERATION AND POWER CONSUMPTION WAS PRODUCED

month	Power generation /kWh	Power consumption /kWh	Amount of profit and loss /kWh
1	188.33	158.10	30.23
2	194.60	142.80	51.80
3	231.09	158.10	72. 99
4	227. 68	153.00	74. 68
5	216. 56	158.10	58. 46
6	169. 60	153.00	16. 60
7	154. 83	158.10	- 3. 27
8	178. 13	158.10	20. 03
9	153. 83	153.00	0. 83
10	147. 92	158.10	- 10. 18
11	160. 22	153.00	7. 22
12	169. 18	158.10	11. 08

Wind and Photovoltaic Power Generation, Wind Power Generation is Given Priority

According to the wind speed data in Dongying area, it can be seen that the average wind speed minimum in July, among them, the system power need to meet

$$Q_c = n_1 \cdot E_f + n_2 \cdot Q_v + Q_b \quad (5)$$

TABLE 5 SCENERY POWER GENERATION AND POWER CONSUMPTION PRODUCED (WIND IS GIVEN PRIORITY TO)

Month	Wind power /kWh	Photovoltaic power generation /kWh	Total generating capacity /kWh	Power consumption /kWh	Amount of profit and loss /kWh
1	89.20	183.09	273.29	158.10	115.19
2	126.64	180.97	309.61	142.80	166.81
3	150.64	203.13	356.77	158.10	198.67
4	138.35	189.67	332.02	153.00	179.02
5	72.18	174.10	251.28	158.10	93.18
6	30.75	136.10	172.85	153.00	19.85
7	18.20	152.56	177.76	158.10	19.66
8	21.60	146.74	176.34	158.10	18.24
9	19.88	130.93	159.81	153.00	6.81
10	22.38	131.98	164.36	158.10	6.26
11	41.26	151.67	203.93	153.00	50.93
12	35.76	165.56	213.32	158.10	55.22

At the same time meet the minimum investment, calculated capacity and power consumption was produced as shown in table 5. Cycle calculated wind generator power for Pf = 1.421 kW; Solar cell phalanx power for Pv = 1.474 kW; Consider solar panels wind generator specification, the actual usable 1.5 kW of photovoltaic phalanx and 2 kW wind generator.

Wind and Photovoltaic Power Generation, Photovoltaic Power Generation is Given Priority

In the premise of the lowest investment, power generation and power consumption was produced as shown in table 6 calculated wind generator power for Pf = 0.367 kW; Solar cell phalanx power for Pg = 1.626 kW.

Consider solar panels, wind generator specification, the actual usable 1.7 kW of photovoltaic phalanx and 1 kW wind generator.

TABLE 6 PV/WIND POWER GENERATION AND POWER CONSUMPTION PRODUCED (MAINLY PHOTOVOLTAIC (PV)

month	Wind power /kWh	Photovoltaic power generation/kWh	Total generation-g apacity /kWh	Power consump-tion /kWh	Amount of profit and loss /kWh
1	23.04	196.50	220.54	158.10	62.44
2	32.71	196.74	231.45	142.80	88.65
3	38.91	224.59	266.5	158.10	108.4
4	35.73	213.20	252.93	153.00	99.93
5	18.64	197.88	221.52	158.10	63.42
6	7.94	154.69	168.63	153.00	15.63
7	5.78	142.20	154.98	158.10	-3.12
8	5.58	165.42	179	158.10	20.9
9	5.58	146.08	160.66	153.00	7.66
10	4.70	145.17	159.87	158.10	1.77
11	10.66	163.98	185.64	153.00	32.64
12	9.24	177.33	198.57	158.10	40.47

Economic Accounting

According to talk on this page, we only consider wind generator and solar cell phalanx cost.

Due to the influence of various factors, wind generator and solar cell price difference is very big, can only be roughly comparison: such as wind power generator price with 08000 yuan/kW meter, the price of solar cell with 42000 yuan/kW meter.

Plan 1 of 12 kw wind generator need to invest 96000 yuan; Scheme 2 of 1.7 kW solar cell need to invest 71400 yuan; Plan 3 of 1.5 kW solar cell need to invest 63000 yuan; 2 kw wind generator need to invest 16000 yuan, a total of 79000 yuan; Scheme of 4 1.7 kW solar cell need to invest 71400 yuan, 1 kW wind generator need to invest 08000 yuan, a total of 79400 yuan.

Conclusion

In view of the above several kinds of schemes, from the total generating capacity, and profit and loss quantity and system cost comparison, it is concluded that the solar wind in the Dongying area comprehensive power generation scheme is the highest price. However, in view of the dongying area produced climate environment difference, wind power and solar power which the Lord which time a bigger difference, through the table 5 and table 6 each data contrast, draw the conclusion: in Dongying area suitable for implementation of solar wind integrated power generation (wind power generation is given priority to) scheme.

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